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NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

**ANALYSIS OF DEFENSE INDUSTRY CONSOLIDATION
EFFECTS ON PROGRAM ACQUISITION COSTS**

by

Russell V. Hoff

December 2007

Thesis Co-Advisors:

Nayantara Hensel
Doug Brook

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REPORT DOCUMENTATION PAGE			<i>Form Approved OMB No. 0704-0188</i>	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE December 2007	3. REPORT TYPE AND DATES COVERED Master's Thesis	
4. TITLE AND SUBTITLE Analysis of Defense Industry Consolidation Effects on Program Acquisition Costs			5. FUNDING NUMBERS	
6. AUTHOR(S) Russell V. Hoff				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited			12b. DISTRIBUTION CODE	
13. ABSTRACT (maximum 200 words) <p>Massive consolidation within the defense industry began after the end of the Cold War. The defense industry felt economic pressures and responded by consolidating at various levels. Merging companies should create a positive synergy by combining the best attributes from each company. This synergy, in theory, should manifest itself in, among other things, a cost savings in defense programs. This thesis examines if cost changes are evident due to consolidation within the defense industry by conducting a regression analysis of Major Defense Acquisition Programs across thirteen broad defense market sectors. The findings suggest that while consolidation may yield savings as a result of synergy, this does not seem to be true for all mergers; they do not always save costs. Furthermore, not every merger experiences a statically significant cost estimate change. Comparison of regression results across all the examined programs suggests that when there is a statistically significant cost change following a merger, that change shows a greater likelihood a cost estimate decrease than an increase. A categorical comparison across defense market sectors, branch of services, prime contractors, and by the company's role during the consolidation experience (i.e., Target or Acquirer) suggest potential trends in cost estimate changes within each category.</p>				
14. SUBJECT TERMS Defense Industry, Consolidation, Merger, Acquisition, Selected Acquisition Report, Major Defense Acquisition Program, Program Costs			15. NUMBER OF PAGES 75	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UU	

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18

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**ANALYSIS OF DEFENSE INDUSTRY CONSOLIDATION EFFECTS ON
PROGRAM ACQUISITION COSTS**

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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF BUSINESS ADMINISTRATION

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ABSTRACT

Massive consolidation within the defense industry began after the end of the Cold War. The defense industry felt economic pressures and responded by consolidating at various levels. Merging companies should create a positive synergy by combining the best attributes from each company. This synergy, in theory, should manifest itself in, among other things, a cost savings in defense programs. This thesis examines if cost changes are evident following consolidation within the defense industry by conducting a regression analysis of Major Defense Acquisition Programs across thirteen broad defense market sectors. The findings suggest that while consolidation may yield savings as a result of synergy, this does not seem to be true for all mergers; they do not always save costs. Furthermore, not every merger experiences a statically significant cost estimate change. Comparison of regression results across all the examined programs suggests that when there is a statistically significant cost change following a merger, and that there is a greater likelihood of cost estimate decrease than an increase. A categorical comparison across defense market sectors, branch of services, prime contractors, and by the company's role during the consolidation experience (i.e., Target or Acquirer) suggests potential trends in cost estimate changes within each category.

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I. INTRODUCTION

A. BACKGROUND

Consolidation of two or more firms is a business decision that can either be internally or externally motivated in order to position the company for economic development. Consolidation of firms can occur in two ways: mergers or acquisitions¹. Two (or more) merging companies should create a positive synergy by combining the best attributes from each company. This synergy, in theory, should manifest itself in, among other things, a cost savings in programs. Possibilities of cost savings may be attributed to synergistic effects such as improved efficiency through organizational restructuring, improvements in technology, or capitalization of particular expertise. Regardless of how the merger or acquisition occurs, theoretically, the two firms should be more efficient together than separately. Thus, there should be some cost savings realized as a result.

Massive consolidation within the defense industry began after the end of the Cold War. According to the Department of Justice (DOJ), the majority of the mergers occurred between 1990 and 1998. The General Accountability Office (GAO) testified before the Senate that the number of defense contractors declined to twenty major contractors in the sectors important to national security (Cooper, 1998, 1). Andrade et al. (2001), Bruner (2004), Gaughan (2006), Mitchell and Mulherin (1996) have shown empirically that consolidation across industries is not a steady trend of mergers and acquisitions (M&A) through the years, but rather in a series of waves showing an “industry-based pattern” (Bruner, 75), clustering by industries (Mitchell and Mulherin, 1996). This pattern, seen in the defense sector, has resulted in the overwhelming majority of defense prime contracts being divided among the five top-tier aerospace and defense contractors (Lockheed-Martin, Northrop-Grumman, Boeing, Raytheon, and General Dynamics) (See the figures in the Appendix).

¹ Conglomerates are a subset of acquisitions. A conglomerate is a consolidation of numerous and mostly unrelated business. General Electric is a good example of a conglomerate.

The policy challenge for the DoD is to balance defense industry consolidation with competition and innovation, while not negatively impacting national security initiatives or exceeding budgetary constraints. The items that directly affect consolidation and costs include: then Deputy Secretary of Defense Perry's memorandum encouraging consolidation, the National Defense Authorization Act for Fiscal Year 1995 enacted to share restructuring costs that result from consolidation, and defense appropriation bills, which constrains agencies' expenditures.

In 1993, then Deputy Secretary of Defense William Perry held a meeting with defense industry leadership to inform them of drastic reductions in future defense expenditures and to encourage them to consolidate. That meeting earned the sobriquet "the Last Supper." The expectation was that the consolidation activities would reduce excess industrial capacity and achieve a cost saving for DoD through reduced overhead costs.

Also in 1993, Norman R. Augustine, then CEO of Lockheed Martin, headed an effort involving other major defense industry executives to persuade DoD to offset the restructuring costs of the mergers. To expedite and encourage consolidation, DoD adopted the policy on 21 July 1993 that allowed restructuring costs to be reimbursed as overhead costs, but only if there were savings to the government. Restructuring payments became an object for scrutiny. An April 1997 GAO report found that the government "reimbursed \$179M of \$849M in costs" and that savings translated to "\$1.93 for every \$1.00 spent" (Cooper, 1997, 4). Congress submitted legislation to end the practice of paying restructuring costs but ended up only restricting the cost payments to pay only if savings were at least 2 to 1² (very close to the GAO amount of \$1.93 found in their report). The Defense Contract Management Agency (DCMA) has lead responsibility for implementing the DoD's restructuring regulations.

The congressionally-approved defense appropriation bill allocates a portion of the United States yearly discretionary federal budget to fund the DoD activities, which includes procurement initiatives. When consolidation began in 1993, the DoD spent close

² Section 804 of Public Law 105-85.

to \$80 billion on procurement (Cooper, 1998, 2). By 1998, those expenditures had precipitously dropped to around 40 percent to \$53 billion (Cooper, 1998, 2).

The defense industry felt economic pressures and responded by consolidating at various levels. When these consolidating companies are building government products, the cost to the government should decrease as a result of increased efficiencies and, thereby, save defense dollars. Since M&A are supposed to be more efficient from the synergistic effect, has the consolidation of defense industry contractors saved acquisition costs for various defense programs? This thesis addresses this question using an empirical analysis of Major Defense Acquisition Program (MDAP) cost data from Selected Acquisition Reports (SAR).

B. RESEARCH QUESTIONS

The following research questions were designed to examine costs associated with M&A and how policy affected M&A and competition, and, possibly, costs. A policy analysis coupled with a regression analysis addresses the relationship merger effects may have had on overall program acquisition costs.

1. Primary Research Question

1. Has defense industry consolidation from 1993-2006 saved acquisition costs for various Major Defense Acquisition Programs (MDAP)³?

2. Secondary Research Questions

1. Why did the Department of Defense (DoD) encourage defense industry consolidation and what policies were developed to support and encourage consolidation?
2. What were the acquisition policy objectives regarding consolidation?
3. What were the acquisition policy outcomes regarding costs?
4. What effect did the defense industry consolidation have on competition?
5. How did program costs change immediately post-merger?

³ Programs are considered a major program if research and development costs exceed \$365 million or its procurement exceeds \$2.19 billion in fiscal year 2000 constant dollars.

6. How did program costs change post-merger allowing time lag (i.e., for synergistic effects to be realized)?
7. How did consolidation affect program costs within various defense sectors?
8. How did consolidation affect program costs within each branch of service?
9. How did consolidation affect program costs with prime contractors within the defense industry?

C. RESEARCH BENEFIT

This thesis examines if MDAP cost changes are evident due to consolidation within the defense industry. The findings of this thesis will provide empirical evidence of how consolidation effects defense program costs.

D. RESEARCH METHODOLOGY

The methodology used in this thesis consisted of: a literature search of books, scholarly and trade journal articles, DoD references, and other information sources on defense industry consolidation; a review of acquisition policy reform affecting defense industry consolidation; a review of previous Government Accountability Office⁴ (GAO) reports and RAND Corporation reports on program costs and policy changes; an organization of Selected Acquisition Report (SAR) cost data on 359 high-cost category DoD programs (DoD, 1980-2006); a regression analysis across thirteen broad defense market sectors to identify statistically significant cost changes occurring post-merger; a comparative analysis of post-merger cost changes across broad defense market sectors, branches of service, prime contractors, and companies' role in the merger or acquisition; and an interpretation of the regression results to identify cost trends and policy reform impacts.

⁴ The General Accounting Office changed its name to Government Accountability Office on 7 July 2004.

E. SCOPE AND LIMITATIONS

This thesis is limited by design to focus on costs changes of Major Defense Acquisition Programs (MDAP). MDAP is not all inclusive of defense budget expenditures. At any given time, there are around 700 DoD major and minor programs; this thesis looks at 358, but, by using certain selection criteria as discussed in a later chapter, culled the number of programs analyzed to 64. Contrary to minor cost programs, data submission is mandatory for MDAP and makes accessing data relatively simple. Although acquisition policy reform is a perpetual activity, this thesis narrowly focuses on those policies that impact consolidation or program cost changes.

This thesis investigates if mergers create synergy that is manifested in a decrease in program costs. This is not an all inclusive study of possible motives and rational of why mergers occur or the nuances, such as the partial absorption of assets, regarding each consolidation within all industries, or the reasons for success or failure, but rather investigates how “mergers of equals” – including horizontal, vertical, and conglomerate (Gaughan, 1996; Haspeslagh and Jemison, 1991; and Weston et al., 1990) in terms of size within the defense industry – may have affected program costs.

F. ORGANIZATION

This analysis compares normalized cost estimates of defense programs that fall among the largest defense contractors to see if savings are realized post-merger. Chapter II contains necessary background information that will build a foundation of certain concepts and practices as well as a literature review that examines perceptions, reports, and studies of cost impacts due to consolidation. Chapter III discusses the evaluation methodologies and Chapter IV presents and discusses the findings of positive or negative cost impacts on government programs following mergers and acquisitions and draws conclusions based on the empirical evidence. Lastly, Chapter V provides the answers to the research questions and provides recommendations for areas of further research to complement these findings.

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II. BACKGROUND AND LITERATURE REVIEW

A. INTRODUCTION

Does consolidation affect program cost? Mergers and acquisitions generate much attention in public and political arenas because of potential economic influences. Congress has the fiduciary responsibility to the people to spend tax money wisely. Because of finite monies available, Congress scrutinizes budget requests and budget expenditures to minimize wasteful spending. Public and political concern on how tax money is spent coupled with the availability of data makes merger savings a controversial topic. First, this section provides background information and examines literature that gives evidence of a skeptical perception plus gives insights to studies whose findings sometimes conflict regarding the cost data validity and accuracy or if cost savings are even achieved. Second, this chapter also introduces the Selected Acquisition Report (SAR), which is the data source used in this analysis. Next, the roles and benefits of competition are discussed. Lastly, policy that impacts the consolidation of the defense industry is introduced.

B. PUBLIC VIEWS

Some mergers and acquisitions, because of the notoriety or the potential economic outcomes, attract the media's interest enough to investigate and publish comments on the situation. One article relates that Lockheed touted the savings that were created from its merger deals, but when pressed to name programs, Lockheed Chairman Norman Augustine could only name one (Pearlstein, 14 July 1997).

A GAO study looked into one method that companies use to profess cost-savings post-merger layoffs (Cooper, 1998, 8). With consolidation, through a merger or an acquisition, the company may undergo some workforce restructuring. The DoD had a policy that paid restructuring costs to consolidating companies, which allowed government and the company to share in the savings realized to the government. The policy gained congressional and public scrutiny because it seemed to reward contractors

for undergoing large-scale downsizing or streamlining of the workforce in the name of cost savings (GAO, April 1996, 3). This procedure earned the stigmatizing label “payoffs for layoffs” from the media.

The impacts of paying restructuring costs were not well received. The outrage about the government paying for restructuring costs is reflected in the bombastic press releases from congressional watchdogs. The Project on Government Oversight (POGO) argues that taxpayers should not bear any financial burden to subsidize defense industry consolidations “especially when [taxpayer’s] money is going towards firing workers.”⁵ Opposition from within Congress sparked debate over the practice of downsizing for the sake of showing cost savings. Rep. Bernie Sanders, during debate of the 1997 defense spending bill argued that “...the taxpayers are providing payoffs for layoffs... [by]...giving multibillion-dollar corporations huge amounts of money in order to merge their companies, stifle competition, and lay off American workers.”⁶

C. POLITICAL VIEWS

Much research and analysis has been done on the costs / benefits of mergers, both pre- and post-merger. GAO and RAND have conducted independent studies to determine program cost changes. The GAO is the congressional agency that, when instructed, studies programs and resultant expenditures of federal monies. The RAND Corporation conducts independent research and analysis to provide findings or additional information to decision makers and analysts.

Company consolidation usually results in a realignment within the new company in order to make more efficient use of assets and, thereby, reduce overall project costs. Sometimes, during the Antitrust Agency’s review of M&A proposals, some consolidating companies are required to consent to divestitures in order to preserve continued market competition. Specifically regarding costs, every year, the GAO has provided Congress

⁵ “Payoffs for Layoffs: Much More Than a Sound Bite,” 11 March 1997, Press release available at <http://www.pogo.org/p/contracts/ca-970311-reform.html>, accessed 1 March 2007.

⁶ Congressional Record, 13 June 1996, Vol. 142, p. H6347, http://frwebgate.access.gpo.gov/cgi-bin/getpage.cgi?dbname=1996_record&position=all&page=H6347, accessed 10 March 2007.

with analyses of varying aspects of defense industry mergers. For example, in 1996, GAO examined the cost savings of the Martin-Marietta and GE Aerospace merger. The GAO found that “showing restructuring savings would result in a net reduction of projected overhead costs” for the five defense programs selected for study (GAO, 1996, 4).

A GAO report looked into how much industry consolidation has taken place to help understand the potential impacts to competition. The report indicated the specific market sectors for DoD to monitor for competition issues if consolidation continued in a particular sector. DoD must have the ability to “identify and address potential harmful effects of mergers and acquisitions” that could impact national security (Cooper, 1998, 1). A further review in 1998, GAO reported that “there is little evidence that the increased consolidation has adversely affected current DoD programs” (Cooper, 1998, 4). The study concluded that “consolidation has brought no real cost savings ... at best defense costs grew at a lower rate” (Cooper, 1998, 2). However, GAO noted that DoD must continue to monitor the previously defined market sectors to avoid future problems.

The GAO, in response to periodic Congressional inquiries, studied defense industry mergers to determine if savings on restructuring cost were realized. Although restructuring savings were less than initially estimated,⁷ savings did occur. The GAO’s first report on results from the DoD policy indicated a \$1.49 in net savings for every \$1.00 paid in restructuring costs (GAO, April 1996, 3). A few months later, GAO examined seventeen Martin-Marietta projects in 1996. GAO found that \$1.00 paid in restructuring costs yielded a \$2.41 savings for the first five projects and \$8.02 for the last three projects⁸ (GAO, September 1996, 4). A later GAO study found, that for the companies studied, the DoD paid \$179.2 million and realizing savings of \$346.7 million. In other words, for every \$1.00 paid in restructuring costs gave an estimated savings of \$1.93 (GAO, 1997, 2).

⁷ In a July 1994 Congressional hearing, the Deputy Secretary of Defense testified that restructuring activities in the defense industry were expected to result in significant benefits to DOD—with savings exceeding costs up to seven times (i.e., \$1.00 in restructuring costs yield up to \$7.00 in savings).

⁸ The review began with seventeen projects was reduced to five. The others projects were either uncertified or were unrelated to business consolidation.

The GAO also conducts a yearly assessment of major weapons programs throughout DoD. In 2004, fifty-one programs whose combined program costs exceed \$672 billion were reviewed (GAO, March 2004, 1). In 2005, GAO assessed 54 programs whose combined investment exceeds \$800 billion (GAO, Mar 2005, 1). In 2006, GAO assessed 52 weapon programs representing a projected investment of about \$850 billion (GAO, Mar 2006, 1). A few program savings were over 10 percent, but some incurred cost increases of over 500 percent; the average over all programs was a cost increase of 30 percent. The reports do not give insight to specific causes of cost increases, but the ramifications are well known: defense program cost increases diminish buying power for the DoD. Mergers and acquisitions during contract performance should show a cost savings, through synergistic effects, but it is not always the case; regardless, increased costs erode government agency's limited budget. Within the limited budget apportionment, there must be a zero sum gain – an increase in costs of one program must be offset by a decrease in expenditure of another.

The RAND Corporation research provides insights on the impacts of consolidation for trend analysis. The RAND Corporation examined how increasing consolidation coupled with diminishing defense program affects competition and innovation – two key aspects DoD expects and antitrust legislators regulate. The research on weapon systems focused on the aircraft industry, but still provides insights on the impacts of consolidation for trend analysis. The RAND Corporation looked at how increasing consolidation coupled with diminishing defense program affects competition and innovation – two key aspects DoD expects and antitrust legislators regulate. The report suggests that having only one or two dominant contractors may reduce the incentives for competition to innovate, even during periods of rising demand (Lorell, 2003, 3). Since competition affects downward pressure on costs, this lack of competition may result in increased costs for defense programs.

Defense industry globalization, too, has potential drawbacks. Foremost is a security concern when the host-country has access to sensitive military technology. The host-country could disclose information or sell technology to other firms/countries. One such situation that demonstrates a negative, and embarrassing, event involves a Dutch

firm acquiring an American firm that made lenses for spy satellites. The Dutch firm could possibly share the technology with potentially hostile countries such as China (Dombrowski et al., 2002, 25).

A policy was enacted to prevent negative impacts that may result from globalization within the defense industry. The Exon-Florio Amendment to the Omnibus Trade and Competitiveness Act of 1988 enacted Section 721 in the Defense Production Act “authorizes the President to suspend or block foreign acquisitions, mergers, or takeovers of U.S.-located firms that pose credible threats to national security” (USD(ALT), 2007, 13). The DoD investigates the proposed transactions to ensure that the national security interests are not jeopardized. In the Annual Industrial Capabilities Report to Congress, the Office of Under Secretary of Defense Acquisition, Logistics & Technology, reported that, during 2006, “a review of the 113 cases indicates that 12 of the transactions (10.6 percent) involved U.S. firms deemed to possess critical technologies and 17 cases (15 percent) involved U.S. firms that were determined to be otherwise important to the defense industrial base” (2007, 19). Disallowing such transactions helps to preserve the US national security.

D. SCHOLARLY VIEWS

Scholars, in an attempt to understand the nature of consolidation impacts began to dissect the cost relationships. Agrawal et al., (1992), conducted a time trend analysis of pre- and post-merger stock prices to examine affects on stockholder value. After adjusting for the firm’s size, they found that, “stockholders of acquiring firms experience a statistically significant wealth loss of about 10% over five years after the merger completion date” (1992, 14). Malatesta (1983) and Andrade et al. (2001), also empirically found that not all mergers proved beneficial in creating shareholder value. Although neither looked exclusively at the defense industry, both analyzed aggregate data for all mergers – both defense and non-defense companies. So, how does the defense industry, exclusive, compare? Driessnack et al., had similar findings within the defense industry. Their analysis indicated “it is not reasonable to expect consolidation will achieve significant benefits in firm stock performance (2003). Korb indicated the difficulty in

detecting merger cost savings, in terms of lower prices for weapons, since, arguably, “the theoretical cost savings from reducing capacity can be offset by the erosion in competition,” (1996) which could raise prices and retard innovation. If the stock price valuation is any indication of a firm’s well-being, then it appears that consolidation can produce a negative synergy.

Defense industry consolidation has impacted expenditures for research and development (R&D). Deutch (2001), a former Under Secretary of Defense Acquisition, Technology, and Logistics, theorized that to cope with acquired debt (through consolidation) and declining market valuations, companies reduce R&D expenditures to stay healthy. Linster et al., (2002), also indicated, through experimentation, that cost pressures for firms remaining after consolidation forced a reduction in efforts to innovate, such as R&D. Their experimentation of defense firm partnerships, which supports earlier research efforts, suggests that fewer resources are devoted to R&D efforts due to a causal relationship of spending during a collective effort (Linster et al., 2002). If consolidating firms are to keep defense program costs low, trade-offs between R&D expenditures and program costs could occur.

Professor Nayantara Hensel, in NPS-AM-07-106 “An Empirical Analysis of the Patterns in Defense Industry Consolidation and Their Subsequent Impact,” (2007) explored, using SAR data, whether cost estimates were higher or lower post-merger across various weapons systems, weapons system categories, and defense contractors. The data and methodology used in this report follow her report, and the conclusions from this analysis are consistent with her findings.

E. SELECTED ACQUISITION REPORT (SAR)

The SAR is a legally mandated⁹ summary report on the cost, schedule, and performance status of major acquisition programs. Each year, the Department of Defense¹⁰ must submit a SAR report to Congress depicting the actual and estimated

⁹ U.S. Code: Title 10, Subtitle A, Part IV, Chapter 144, § 2432 Selected Acquisition Reports.

¹⁰ The Office of the Secretary of Defense (OSD), Acquisition Resource and Analysis (ARA) consolidates and prepares the report.

costs¹¹ and quantities of items the defense industry is currently working on. Congress can select specific programs of interest, but annual SAR cost data are mandatory for all programs in excess of \$40,000,000 and not procured with a firm, fixed price contract. By exception, quarterly submissions are necessary if programs experience a unit cost increase of 15 percent or greater or a schedule delay of six months or greater,¹² Congress uses the SAR as a legislative oversight tool to better understand defense program expenditures in order to make future budgetary decisions. The SAR is prepared in conjunction with President's budget so that individual program cost proposal can be compared to the health the existing program. Information contained within the SAR comes directly from the program manager and is electronically compiled for a consolidated report. Each program's current cost estimate is stated in terms of a base year in order to normalize inflationary impacts. Because Congressional decisions stem from SAR cost data analysis, analysts generally accept the SAR data as a viable database. However, it is not without fault as explained in a later chapter.

Since the SAR cost reporting began 1969, Congress has made changes to the reporting structure to attempt to gain a better understanding of cost changes (specifically cost growth). While the SAR data are widely used and accepted, it is not without its shortcomings. Analysts must understand how these deficiencies affect cost pricing data to have more meaningful results. Some major problems that distort cost estimates if not normalized or accounted for include: shifting of the base year during program performance, changes in quantities, costs shared among joint programs, and varying inflationary estimates (Hough, 1992, 12-32).

Among some analysts, there is skepticism regarding the complete cost of defense programs. The GAO expressed reservations about the quality of the data contained in the SAR for Major Weapon Systems (1988). The GAO also noted that in 1993 the Army did not report all relevant cost figures for the Blackhawk helicopter. The same report compared the Army's various budget accounting mechanisms and found \$187.5 million

¹¹ Total actual funding for prior years and estimated funding for future years.

¹² Programs having a Milestone B or Milestone C approval that occurs within the reportable quarter are also included.

that was not included in the SAR report to Congress¹³. Defense guidance on preparing SAR seemingly implies some latitude on the types of costs required for inclusion, since total modification, support, and operating costs are not included in SAR data (GAO, 1988). Understandably, some internal management reports separate the various cost categories to minimize cross spending of different “colors of money”; however, the GAO found that the Army did not “consistently report the same dollar amount for the same types of costs in different reports” (GAO, 1988, 5). Some analysts believe that inaccuracies in reporting are due to inaccurate program estimates. They have demonstrated that analytical tools such as logistic and multiple regressions can assist with more accurate program estimate determination (Moore and White, 2005; Tracy and White, 2005). Cost data in reports are only as good as the inputs. A lack of consistency and accuracy in reporting total program costs leaves Congress with an uncertain budget picture from which to make accurate fiduciary decisions.

The GAO has conducted reviews of the SAR and has identified various problems with and within the SAR. One report identified that the majority of program cost increases were in the categories of cost estimates and quantity (GAO, 1988). This suggests that the responsibility of cost changes occur at various levels. For instance, cost estimates are inputted at the program manager level while quantity is determined at a higher agency level. Quantity can also be affected by changes in demand at the user level (i.e., require more or less of the items) or changes in program budget (i.e., less funding equates to a decrease in the number that can be purchased). The GAO found data are not reported consistently on the same systems and the data are often incomplete (i.e., all known costs are not included) (GAO, 1988). Another inconsistency in data is due to a lack of standardized rates used to remove inflationary impacts. The GAO found that cost changes due to economic factors were calculated in various ways. For instance, program cost projection decreases “resulted from either inflation being less than anticipated or having lowered the rates for future expected inflation” (GAO, 1988, 10). Variations of

¹³ Calculated by author using information within the GAO report, Table 1.

calculations also differ across the services. Within the same time period, the Navy and the Air Force reported cost projection decreases due to economic factors, while the Army reported an expected increase (GAO, 1988).

While the problems with the SAR are recognized, it becomes difficult to make changes that all agencies can agree upon (GAO, 1988). Many changes have been identified, including: the need to update costs after fielding (GAO, 1990), automated report submissions and submission (GAO, 1989), inclusion of graphics (GAO, 1986), inclusion of complete life-cycle costs (GAO, 1989, 1990), and better accounting and financial systems (GAO, 1990). Regardless of the SAR deficiencies, the information contained within is a useful tool. While it may be difficult to determine an exact dollar amount, the SAR can provide a rough indicator or order of magnitude of program cost changes.

F. POLICY

The most recent wave of consolidation began early in the Clinton administration with Defense Secretary Perry's 1993 meeting with defense industry leaders. The subsequent and sustained decline in Defense appropriations from 1993 to 2001 helped to encourage consolidation through economic pressures. The government's July 1993 policy to share in savings by paying restructuring costs further motivated defense industry consolidation. As found by GAO, the costs savings were not as high as expected. The Congress, in an attempt to add more oversight to restructuring costs paid, enacted section 818 of the National Defense Authorization Act for Fiscal Year 1995. This section requires an audit of proposed cost savings and a certification from a senior DoD official. Section 818 also required an annual report to Congress on restructuring activities and associated costs. Determination of restructuring costs was revised in Section 8115 of the National Defense Appropriations Act for Fiscal Year 1997, and Section 8092 of the National Defense Appropriations Act for Fiscal Year 1998 that included provisions for the audit and certification authority regarding saving thresholds.

The payment of restructuring costs, provided the appropriate ratio of savings to payouts (2 to 1) is achieved, continues as an allowable cost as outlined in the Federal Acquisition Regulation part 31. It is further promulgated in the DoD derivative of the Federal Acquisition Regulation.¹⁴

To assist in cost estimate analysis, the Office of the Secretary of Defense (OSD) Program Analysis and Evaluation (PA&E) established the Defense Cost and Resource Center (DCARC) in 1998 to “collect historical Major Defense Acquisition Program costs....and make those data available for use by authorized government analysis to estimate the cost of ongoing and future government programs, particularly DoD weapon systems.”¹⁵ The DCARC combines information from required acquisition reports into a single, searchable database for authorized government users to access to assist in program cost estimates.

In an attempt to reduce program cost increases, DoD made changes to acquisition policy regarding more stringent measures to more accurately estimate program schedules. GAO reported that of the 23 major programs across DoD, 10 experienced cost overruns (GAO, April 2006, 8). During the five year span, companies working on those programs have consolidated among the defense industry. It becomes difficult to pinpoint the nature of the increases, whether due to policy changes or synergies unrealized.

The Office of the Deputy Under Secretary of Defense (Industrial Policy) (ODUSD(IP)) monitors the health of the U.S. defense industry. Annually, the ODUSD(IP) issues a report to Congress (Annual Industrial Capabilities Report (AICR) to Congress) outlining the state of the defense industry. Their focus is ensure that DoD policies, procedures, and action enable the U.S. to maintain a reliable, cost-effective, and sufficient industrial base¹⁶ that promote national security goals. The ODUSD(IP) elaborates that reliability, cost effectiveness, and sufficiency mean a timely delivery of products and services at or below cost targets that meet the prescribed performance

¹⁴ DFARS 231.205-70, External Restructuring Costs; DFARS 242.1204, Novation Agreements

¹⁵ Defense Cost and Resource Center, <http://dcarc.pae.osd.mil/>, accessed 18 August 2007.

¹⁶ ODUSD(IP) Homepage, <http://www.acq.osd.mil/ip/>, accessed 5 September 2007.

requirements. A means to achieve their goals is through policy recommendations that encourage competition and innovation. By highlighting industrial base deficiencies for critical technologies and implementing appropriate policy initiatives and remedies, the Department is positioned to facilitate innovation that promotes joint, cross-Service warfighting (AICR, 2004). The 2005 report indicated that the defense industrial base is not overly consolidated with sufficient competition that encourages innovation (AICR, 2005). In the 2006, the study concluded that “a stable, robust, DoD funding is the primary factor in sustaining essential industrial capabilities supporting defense because such funding focuses market demand across a broad spectrum of industry segments to meet emerging and projected DoD requirements” (AICR, 2006, 1).

G. COMPETITION

Open competition provides businesses the opportunity to compete on price and quality. While consolidation may be necessary to reduce excess capacity, absorb specialty technology/techniques, or garner market power, competition is in the best interest of the government to keep costs low and to encourage innovation. Competition is such an important part in gaining best value and preserving innovation that the DoD, the Department of Justice (DOJ), and the Federal Trade Commission (FTC) must render approval before M&A occur.

The DoD role in reviewing consolidation proposals within the defense industry is to ensure advancement of national security goals. Foremost, the DoD’s responsibility lies with maintaining national security; the DoD does not support consolidation that negatively impacts national security or hampers innovation. The DoD examines mergers to ensure a viable defense industrial base will remain after the proposed consolidation. The DoD also examines to see how the proposed consolidation will impact competition and innovation.

The FTC and DOJ (the “Antitrust Agencies”) have concurrent jurisdiction over merger authorization and have responsibility to enforce antitrust laws. The FTC and DOJ focus on one overriding issue: “the likelihood that the transaction will harm customers in any relevant product market through increased prices or lower product quantity, quality

or service levels, or reduced technological innovation” (Pitofsky, 1997). The DOJ dedicates an entire division, the Antitrust Division, to review and approve only M&As that do not stifle competition or violate antitrust laws (DOJ & FTC, 1997, 4). Diminished competition results in higher acquisition costs, higher per unit prices, and less innovation on U.S. military products.

Jacques Gansler, a former Under Secretary of Defense for Acquisition, Logistics, and Technology, is a large proponent of consolidation, globalization, and transatlantic partnerships. It was under his direction that consolidation was emphasized. He continues to advocate for consolidation, but not at the expense of competition (Gansler, 1999). He also acknowledges globalization is occurring and recommends its support in order to facilitate global partnerships and strengthen ally relationships, but not at the expense of breaches of confidentiality or security (Gansler, 1999).

Economic pressures to consolidate continued to test the limits of allowable competition. Horizontal mergers continued until, at the top tier, only two or three remained in a single sector (i.e., General Dynamics and Northrop Grumman in shipbuilding; or Lockheed Martin and Boeing in aircraft manufacturing). DOJ would not allow a monopoly, which, obviously, defies antitrust laws. The next recourse some firms chose to continue in order to respond to market pressures was to pursue vertical integration (combining buyers and sellers) of lower tier suppliers. Once again, antitrust issues arose and prevented some mergers in which all primes could not access to supplies. One speculation of how top- and sub-tiers circumvent antitrust laws is by establishing strict buyer-seller relationships, thus controlling the vertical supply chain.

Defense industry consolidation means there are fewer bidders pursue government contracts and, thus, makes it harder for the government to obtain the advantages of competition. The DOJ is concerned that mergers of firms in critical technologies may, during the bid evaluation process, withhold essential (and discriminating) technology from competitors and shut out competition (Kramer, 1999). That is, the firm with the latest technology could, essential, resort to monopolistic practices of market and cost control. Kovacic and Smallwood, in an analysis of defense mergers, (1994) saw the need to “preserve important rivalries” so that competition remains in critical technology areas.

Innovation continues as firms compete within their core competencies or niche areas of expertise. Gansler, too, in a multitude of addresses, advocates defense industry consolidation, but not at the cost of competition or innovation. The DoD does not discouraging further consolidation or divestiture, but continues to monitor the health of the defense industry in order to preserve defense industrial capabilities.

H. CHAPTER SUMMARY

This chapter provided some background information and reviewed literature regarding many aspects of consolidation and highlights the varying degrees of political and public support. There seems to be some public and congressional skepticism that cost growth occurs regardless of consolidation. This chapter also reviewed various reports on implications of consolidation regarding program costs and government cost savings. The next chapter outlines the methodology used in determining program cost impacts due to industry consolidation. It reviews some underlying assumptions and explains how the SAR data are organized for regression analysis.

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III. METHODOLOGY

A. INTRODUCTION

There are various ways that program costs are reported, each report having its own specialized function. This analysis's sole source of raw data is from MDAP SAR data. Although SAR cost information is available for hundreds of programs dating back to December 1969, this analysis looks at 359 programs across thirteen broad defense market sectors during the last wave of mergers from 1980 to 2006. The program's information was collected from MDAP SAR submittals and consolidated to provide a representation of total cost estimate changes, if any, throughout the SAR reporting span attributable to consolidation. A regression analysis examines these data to explore for an empirical relationship post-merger effects may have on program cost changes.

B. ASSUMPTIONS AND GUIDELINES

This analysis incorporated a few assumptions and guidelines to assist in selected programs and to highlight factors used in the analysis methodology. Many of these assumptions and guidelines were also used in Hensel (2007). They are indicated below:

- Only mergers of equals were examined, that is, two companies of relatively equal size and functional capability (dominance) within their respective markets. Acquisitions of smaller or “niche” companies are not included. The assumption here is that smaller acquired companies have minimal effect on the parent company's performance or that it is difficult to determine if the small company's specialization is significant enough to impact the larger, newly-formed company. Mergers of equal but from two different industry sectors do not affect cross sector programs (i.e., While working on aircraft program, Northrop-Grumman acquires Newport News (primarily a shipbuilding company) and is assumed to not assist in the program).
- Three months after the merger date (or the next closest chronological SAR reporting date following the three months) were needed to fully recognize any synergistic effects of a merger.
- A merger must have occurred during the program's performance. Only mergers with adequate time pre- and post-merger were considered (i.e., at least three SAR reports before and after the merger date)

- For multiple mergers, each merger was regressed separately using each merge date. Each segment is considered a separate program for this analysis.
- Programs had to have adequate program duration in which to have at least seven SAR reporting periods.
- Program is branch of service specific (i.e., the cost data is not combined where two services purchase the same product)
- Base year remained constant during project duration. Programs changing base years were regressed separately using the single base year.
- If Company A began work on a program and Company B purchased that company, Company A is considered the “Target” company. Conversely, if Company A began work on a program and purchased Company B, Company A is the “Acquirer.”

After screening the programs using the criteria listed in Section 2, fifty singular programs remained, but by treating multiple mergers within the same program as a separate program, the number of programs is sixty-four. (See Appendix B)

C. SAR DATA SETUP

The SAR data contains costs and cost estimates and are required annually, although there are situations requiring quarterly submissions, as stated in a previous chapter. By program, all SAR data are arranged chronologically according to SAR submission dates. Costs using current year estimates in base year dollars were used to minimize inflationary impacts. While the SAR also divides cost changes into separate categories (e.g., quantity, schedule, engineering, estimating, support cost changes, and other cost changes) for trend analysis, only the total procurement cost estimate in base year dollars was used in this analysis as it encompasses overall cost changes in their entirety. Each program was then classified using thirteen broad defense categories: Surface Ship (e.g., aircraft carriers, cruisers), Submarine, Fixed Wing Aircraft, Rotary Wing Aircraft, Tactical Wheeled Vehicle, Tracked Combat Vehicle, Tactical Missile (e.g., air-to-air, air-to-ground), Strategic Missile (e.g., nuclear, ballistic), Expendable Launch Vehicle (e.g., rockets), Satellite, Munitions (e.g., bombs, artillery, submunitions), Torpedo, and Strategic Electronics (e.g., communication, radar, navigation). The defense market categories mirror those indicated in the 1998 GAO report titled, “Competitive

Effects of Mergers and Acquisitions,” but with the addition of the strategic electronic and the munition categories. Table 1 illustrates how SAR data is organized with an example program.

Defense Market Sector	Weapon System Name	Base Year	SAR submittal date	Military Service	Current Cost Estimate in Base Year \$	Primary Contractor	Weapon System Type
Fixed Wing Aircraft	AV-8B Remanufacture	1994	6/30/1995	Navy	1920.9	McDonnell Douglas	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	9/30/1995	Navy	1920.9	McDonnell Douglas	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	12/31/1995	Navy	2041	McDonnell Douglas	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	3/31/1996	Navy	2041	McDonnell Douglas	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	6/30/1996	Navy	2041	McDonnell Douglas	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	9/30/1996	Navy	2041	McDonnell Douglas	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	12/31/1996	Navy	1959.5	McDonnell Douglas	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	6/30/1997	Navy	1959.5	McDonnell Douglas	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	9/30/1997	Navy	1959.5	McDonnell Douglas	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	12/31/1997	Navy	1888.4	McDonnell Douglas	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	6/30/1998	Navy	1888.4	Boeing	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	9/30/1998	Navy	1888.4	Boeing	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	12/31/1998	Navy	1949.3	Boeing	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	6/30/1999	Navy	1949.3	Boeing	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	9/30/1999	Navy	1949.3	Boeing	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	12/31/1999	Navy	1961.3	Boeing	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	6/30/2000	Navy	1961.3	Boeing	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	9/30/2000	Navy	1957.2	Boeing	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	9/30/2001	Navy	1957.2	Boeing	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	12/31/2001	Navy	1991.6	Boeing	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	6/30/2002	Navy	1991.6	Boeing	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	9/30/2002	Navy	1991.6	Boeing	Aircraft
Fixed Wing Aircraft	AV-8B Remanufacture	1994	12/31/2002	Navy	1999	Boeing	Aircraft

Table 1. Example Program SAR information

D. REGRESSION ANALYSIS

Since this analysis specifically examines whether a system experienced higher or lower costs following a merger, a regression model was necessary to examine a program’s cost estimate over time. The regression model and the variables used follow Hensel (2007). The current cost estimates normalized by the base year was the dependent

variable of the regression model. Within the regression model, a time trend variable and a dummy variable became the explanatory variables. The time trend variable is a means of controlling for time related patterns within the program's reporting periods. This was accomplished using a continual variable classification by consecutively numbering the program's cost according to chronological SAR submission dates. The indicator variable, or dummy variable, is a binary classification for mergers and consist of zeroes for pre-merger dates and ones for post-merger dates to differentiate the pre- and post-merger time periods.¹⁷ Regressions were done in two sets. The first assumed post-merger effects occurred immediately and, as such, included an indicator variable value of 1 as close as possible to the merger date or next successive SAR report date.

The second set of regressions accounted for a three month lag to allow time for post-merger synergistic effects to occur. If there was no SAR report submitted at the three month point, the next following SAR report was used. For example, a three month lag from the 1 August 1997 merge date would ordinarily be 1 November 1997; however, the nearest SAR report is on 31 December 1997, and, therefore, is used instead.

The resulting regression model used follows Hensel (2007):

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2$$

- Y: Current Estimate in Base Year Dollars
- β_0 : y-intercept coefficient
- X_1 : Time Trend Explanatory variable
- X_2 : Dummy Variable Explanatory variable

After running the regression, the p-value for each of the explanatory variables indicated statistical significance for typical testing levels (i.e., alpha level of .10 or less). The p-value is the probability of a type-II error, in this case, a cost savings when it is actually a cost growth, and vice versa. For instance, a p-value of 0.0001 means that there is only one chance in 10,000 that a type-II error occurred by chance. The dummy variable coefficient for a particular system determined if the cost estimate increased or decreased as a result of industry consolidation. A negative dummy variable coefficient indicated a

¹⁷ Merger dates were obtained by examining news releases from the company, as well as by using Thomson Financial's and Bloomberg's databases.

cost savings possibly attributed to synergistic effects of the merger. Conversely, a positive coefficient indicates that the cost estimate increased over time.

Once the regressions were completed, they were analyzed. For this analysis, p-values of greater than 0.1 were considered not statistically significant. The results were grouped together into various categories such as defense market sector, branch of service, contractor, program, and target versus acquirer to examine overall trends and for trend comparison.

E. CHAPTER SUMMARY

This chapter explained the assumptions that guided the regression analysis of SAR data to explore whether program cost changes following a merger. This chapter also described how the data are organized and the methodology behind the regression analysis. The following chapter presents the findings.

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IV. PRESENTATION OF FINDINGS

A. INTRODUCTION

Using the methodology as previously described, this chapter presents the regression analysis findings. First, the two sets of program cost regressions are presented to explore for statistical significance commensurate with when post-merger effects are assumed to occur. Second, the statistical significance of the assumed post-merger effects timeframes is compared. Last, using the program cost regressions, the results are categorized by defense market sector, branch of service, prime contractor, and consolidation based on target or acquirer company.

B. FINDINGS

Table 2 shows the regressed data for weapon systems to identify a post-merger cost change beginning at the SAR Nearest to the Effective Date of the Merger. Table 3 shows the regressed data for weapon systems allowing for a three-month (or more, depending how the merger date coincides with SAR submittal dates). For both tables, the first column is the weapon system name or acronym; the second column shows the coefficient of the post-merger indicator variable, but more importantly, its sign; the third column indicates p-value for the statistical significance of the indicator variable; the fourth column is the coefficient of the time trend variable, including its sign; the last column indicates the p-value for the statistical significance of the time trend variable. This set-up follows Hensel (2007).

There is a wide variation of statistical significance for the cost changes, using an alpha test level of ≤ 0.1 , among all weapon systems analyzed. Roughly half (24%) of the programs that have a statically significant indicator variable show a positive coefficient thus signifying a cost estimate increase. Alternatively, 31% of the programs that have a statically significant indicator variable show a negative coefficient thus signifying a cost estimate decrease. This suggests that cost estimates had a likelihood of experiencing a

decrease post-merger. Further analysis by categorizing the data in various ways is necessary to provide a better understanding of post-merger, program cost relationships.

Weapon System^{18,19}	Coefficient of post-merger indicator variable	P-value on coefficient of post-merger indicator variable	Coefficient of time trend variable	P-value on coefficient of time trend variable
ADDS	1076.415	0.000	-64.910	0.000
AFATDS	-562.553	0.224	82.387	0.255
AH-64	36.961	0.763	47.257	0.000
AIM-9X	9.680	0.895	1.002	0.684
AMRAAM	-1635.327	0.000	38.090	0.022
ASAS using MM and LH Merge dates	-1419.660	0.000	16.395	0.046
ASAS using LM & Loral Merge dates	179.459	0.640	-94.098	0.010
ATACMS using N acquiring LTV dates	414.584	0.061	11.928	0.239
ATACMS using N merge G dates	625.374	0.008	-2.777	0.818
ATACMS using LH and MM merge dates	22.491	0.932	24.882	0.099
ATACMS-BAT using N & G merge dates	932.540	0.044	63.164	0.001
ATACMS-BAT using LM & MM merge dates	1456.657	0.000	32.566	0.073
AV-8B Remanufacture	-113.645	0.001	6.545	0.005
B-1 CMUP-JDAM	-169.680	0.000	-2.956	0.322
Bradley FVS	-314.713	0.007	-1.619	0.624
C-130H	-2638.946	0.316	-316.623	0.499
C-17A	-2997.765	0.147	867.662	0.000
CEC	205.759	0.055	72.051	0.000
CMU	39.423	0.008	6.031	0.000
Comanche (RAH-66)	-480.168	0.114	121.981	0.000
DDG-51 using GD and BIW merge date	-2881.234	0.181	583.999	0.000
DDG-51 using GD and NASSCO merge date	-8303.437	0.000	701.224	0.000
DMSP	15.714	0.322	6.557	0.000

¹⁸ B=Boeing; MD=McDonnell Douglas; MM=Martin Marietta; LH=Lockheed; N=Northrop; G=Grumman; GD=General Dynamics; RI=Rockwell International; R=Raytheon; TI=Texas Instruments Defense and Electronics; HA=Hughes Aircraft; HD=Hughes Defense; BIW=Bath Iron Works; NN=Newport News.

¹⁹ Descriptions of each system can be found at the Federation of American Scientists website, www.fas.org, accessed 1 March 2007.

Weapon System^{18, 19}	Coefficient of post-merger indicator variable	P-value on coefficient of post-merger indicator variable	Coefficient of time trend variable	P-value on coefficient of time trend variable
F/A-18 E/F using B and RI merge date	-8497.550	0.036	-444.886	0.090
F/A-18 E/F using B and MD merge date	-15059.459	0.000	-136.510	0.392
F-22 using LH and MM merge date	-6951.452	0.003	84.001	0.313
FBCB2 using NG and TRW merge date	84.489	0.814	-87.531	0.116
Global Hawk using NG and TRW merge date	-1144.043	0.000	133.529	0.000
JDAM using Boeing and MD merge date	-848.820	0.015	144.485	0.000
JPATS using R & Beech Aircraft merge date	-1214.357	0.102	403.860	0.002
JSIPS using R and E-systems merge date	-18.054	0.415	-0.072	0.969
JSIPS using R and HA merge data	48.510	0.018	-4.626	0.009
JSIPS using R and TI merge data	35.657	0.085	-3.497	0.039
JSOW using R and TI merge date	542.248	0.609	-9.995	0.827
JSTARS using N & G merge date	-1291.266	0.006	132.997	0.000
LHD 1 using NG & Litton & Ingalls merge date	251.019	0.210	53.765	0.000
LHD 1 using NG and NN merge date	144.317	0.476	55.225	0.000
Longbow Apache using B & MD merge data	889.256	0.002	-6.432	0.581
LPD 17 using NG and A merge date	3153.504	0.035	-108.166	0.287
MCS (ATCCS) using LM & Loral merge date	179.676	0.046	-12.833	0.003
MLRS using N & LTV merge date	-28.854	0.744	28.307	0.000
Minutemann III PRP using ATK and Thiokal merge date	115.211	0.246	-3.423	0.573
MK-48 ADCAP using Hughes missile & GD Missile merge date	-2315.352	0.007	-42.212	0.564
NAS using R and E-systems merge date	207.563	0.047	25.757	0.000

Weapon System^{18,19}	Coefficient of post-merger indicator variable	P-value on coefficient of post-merger indicator variable	Coefficient of time trend variable	P-value on coefficient of time trend variable
NAS using R & TI merge date	-266.038	0.005	40.330	0.000
NAS using R & HD merge date	-47.789	0.643	31.169	0.000
NAVSTAR User Eqmt using B & RI merge date	-212.399	0.013	29.502	0.000
NESP using Raytheon & Hughes Aircraft merge date	72.762	0.005	-5.994	0.000
Patriot Pac-3 using R and HA merge date	-399.635	0.131	165.078	0.000
SBIRS using LM & Loral merge date	-712.952	0.450	271.916	0.013
SMART-T using Raytheon and Hughes aircraft merge date	-162.308	0.002	-0.789	0.840
SSN-21/AN/BSY-2 using GD and Bath Iron Works merge date	5217.942	0.155	-438.829	0.026
SSN-21/AN/BSY-2 using GD and NASSCO merge date	4094.135	0.202	-312.487	0.020
STD MSL 2 (BLKS I-IV) using R & E-systems merge date	-1372.720	0.090	12.295	0.549
STD MSL 2 (BLKS I-IV) using R & HA merger date	-1308.101	0.082	7.951	0.660
Stinger RMP	397.534	0.055	-67.029	0.001
Strategic Sealift using GD and NASSCO merge date	16.268	0.913	22.609	0.026
T-45TS using Boeing and MD merge date	-54.004	0.826	38.541	0.001
THAAD ²⁰ using LM & Loral merger dates.	-74.049	0.782	206.228	0.000
Titan IV using LH and MM merge date	-9604.986	0.000	504.366	0.000
Tomahawk using Hughes Missile and GD Missile merge date	14.456	0.972	23.953	0.034
TOW2 using Hughes Missile and GD Missile merge date	-135.132	0.218	25.521	0.000

²⁰ THAAD is a DOD program; however, the program is managed by the Army and, as such, is included in this analysis as an Army specific program.

Weapon System^{18, 19}	Coefficient of post-merger indicator variable	P-value on coefficient of post-merger indicator variable	Coefficient of time trend variable	P-value on coefficient of time trend variable
Trident II MSL (D-5) using LH & MM merge date	-2111.671	0.056	10.351	0.679
Trident II MSL (D-5) using LM & Loral merge date	259.864	0.811	-36.213	0.141

Table 2. Regression Results with the Post-merger Effect Beginning at the SAR Nearest to the Effective Date of the Merger

Weapon System	Coefficient of post-merger indicator variable	P-value on coefficient of post-merger indicator variable	Coefficient of time trend variable	P-value on coefficient of time trend variable
ADDS	1134.148	0.000	-68.655	0.000
AFATDS	-655.607	0.148	95.076	0.179
AH-64	36.961	0.763	47.257	0.000
Aim-9x	12.303	0.849	0.880	0.737
AMRAAM	-1635.327	0.000	38.090	0.022
ASAS using MM and LH lagged Merge date	-1419.660	0.000	16.395	0.046
ASAS using MM and LH lagged Merge dates	435.748	0.236	-112.192	0.002
ATACMS using N & LTV lagged merge date	515.896	0.019	6.832	0.505
ATACMS using N & G lagged merge date	425.944	0.089	5.875	0.663
ATACMS using LH and MM lagged merge dates	22.491	0.932	24.882	0.099
ATACMS-BAT using M & G lagged merge date	1033.998	0.019	55.986	0.004
ATACMS-BAT using LM & MM merge dates	1456.657	0.000	32.566	0.073
AV-8B Remanufacture using B and MD lagged merge date	-116.947	0.001	7.088	0.004
B1- CMUP-JDAM using lagged B & RI merge date	-67.867	0.274	-16.840	0.101
Bradley FVS using GD and Chrysler lagged merge date	-261.176	0.025	-2.086	0.556

Weapon System	Coefficient of post-merger indicator variable	P-value on coefficient of post-merger indicator variable	Coefficient of time trend variable	P-value on coefficient of time trend variable
C-130H using LML GD lagged merge dates	618.330	0.835	-815.520	0.187
C-17A using B and MD lagged merge data	-2366.344	0.255	857.154	0.000
CEC using R and HA lagged merge date	205.759	0.055	72.051	0.000
CMU using R and E-sys lagged merge date	19.947	0.195	7.134	0.000
Comanche using B and MD lagged merge date	-428.818	0.157	118.975	0.000
DDG-51 using GD and BIW lagged merge date	-4241.243	0.047	618.211	0.000
DDG-51 using GD and NASSCO lagged merged date	-7864.683	0.000	687.088	0.000
DMSP using LH & MM lagged merge dates.	15.714	0.322	6.557	0.000
F/A-18 E/F using B and RI lagged merge date	-11760.287	0.002	-280.938	0.202
F/A-18 E/F using B and MD lagged merge date	-18423.336	0.000	-17.240	0.618
F-22 using LH and MM lagged merge date	-6951.452	0.003	84.001	0.313
FBCB2 using NG & TRW lagged merge date	-221.030	0.522	-49.847	0.320
Global Hawk using NG & TRW lagged merge date	-857.232	0.024	125.916	0.006
JDAM using Boeing and MD lagged merge date	-822.245	0.019	146.665	0.000
JPATS using R & Beech Aircraft merge date	-865.027	0.295	373.847	0.008
JCIPS using R and E-sys lagged merge date	-11.502	0.620	-0.460	0.822
JCIPS using R and HA lagged merge date	48.510	0.018	-4.626	0.009
JCIPS using R and TI lagged merge date	24.360	0.244	-2.589	0.103
JSOW using R and TI lagged merger date	1631.275	0.126	-50.687	0.276
JSTARS using N & G lagged merge date	-1326.055	0.004	131.971	0.000

Weapon System	Coefficient of post-merger indicator variable	P-value on coefficient of post-merger indicator variable	Coefficient of time trend variable	P-value on coefficient of time trend variable
LHD 1 using NG and Ingalls and Litton lagged merge date	144.317	0.476	55.225	0.000
LHD 1 using NG and NN lagged merge date	92.409	0.652	55.916	0.000
Longbow Apache using B and MD lagged merge date	1030.945	0.000	-14.458	0.210
LPD 17 using NG & A lagged merge date	5420.160	0.000	-274.957	0.000
MCS (ATCCS) using LM & Loral lagged merged date	194.908	0.033	-13.599	0.002
MLRS using N & LTV lagged merge date	-34.901	0.693	28.377	0.000
Minuteman III PRP using ATK and Thiokol lagged merge date	70.572	0.484	-1.060	0.864
MK-48 ADCAP using Hughes missile & GD Missile merge date	-3417.718	0.000	38.217	0.171
NAS using R & E-sys lagged merge date	262.014	0.005	23.688	0.000
NAS using R & TI lagged merge date	-47.789	0.643	31.169	0.000
NAS using R and HDS lagged merge date	-70.238	0.504	32.246	0.000
NAVSTAR User Eqmt using B and RI lagged merger date	-191.890	0.024	28.756	0.000
NESP using Raytheon and Hughes Aircraft lagged merge date	56.997	0.037	-5.427	0.000
Patriot Pac-3 ²¹ using R and HA lagged merge date	-454.014	0.064	167.821	0.000
SBIRS using LM and Loral lagged merge date	-606.365	0.533	273.514	0.025
SMART-T using Raytheon and Hughes aircraft lagged merge date	-162.308	0.002	-0.789	0.840

²¹ Patriot Pac-3 is a DOD program; however, the Army manages the program and, as such, is included in this analysis as an Army specific program.

Weapon System	Coefficient of post-merger indicator variable	P-value on coefficient of post-merger indicator variable	Coefficient of time trend variable	P-value on coefficient of time trend variable
SSN-21/AN/BSY-2 using GD and Bath Iron Works lagged merge date	5756.415	0.116	-463.305	0.019
SSN-21/AN/BSY-2 using GD & NASSCO lagged merge date	3719.280	0.258	-288.665	0.024
STD MSL 2 (BLKS I-IV) using R & E-systems lagged merge date	-1302.107	0.105	10.483	0.605
STD MSL 2 (BLKS I-IV) using R & HA lagged merger date	-1372.720	0.090	12.295	0.549
Stinger RMP	437.198	0.026	-68.557	0.000
Strategic sealift using GD & NASSCO lagged merge date	93.856	0.506	19.345	0.028
T-45TS using B & MD lagged merge dates	-130.784	0.601	41.480	0.001
THAAD using LM and Loral lagged merge date	3.629	0.990	200.490	0.000
Titan IV using LH & MM lagged merge date	-10094.531	0.000	513.138	0.000
Tomahawk using Hughes Missile and GD Missile merge date	117.352	0.770	21.899	0.046
TOW2 using Hughes Missile and GD Missile merge date	-83.516	0.471	24.132	0.000
Trident II MSL (D-5) using LH & MM lagged merge date	-2111.671	0.056	10.351	0.679
Trident II MSL (D-5) using LM and Loral lagged merge date	794.019	0.459	-46.146	0.057

Table 3. Regression Results with the Post-merger Effect at the Second Nearest SAR to the Effective Date of the Merger

Table 4 compares the statistical significance of post-merger effects beginning at the merger date with the post-merger effects allowing for a three-month lag. As shown in Table 4, not every merger experiences a statically significant cost estimate change. The

statistical significance of post-merger cost estimate changes are similar regardless of if the effects were assumed to occur at the merger effective date (54.69%) or allowing for a three month lag (50%). The remainder of this analysis will focus on the more statistically significant assumption of the post-merger effect begins at the SAR closest to the merger date. It is interesting to note that the cost estimates are more likely to decrease in each assumed situation. These results are similar to Hensel (2007).

	Percentage of systems experiencing a positive and statistically significant change post-merger	Percentage of systems experiencing a negative and statistically significant change post-merger	Percentage of systems experiencing a statistically significant post-merger
Post-merger effect begins at the SAR closest to the merger effective date	23.44%	31.25%	54.69%
Post-merger effect begins at the second nearest SAR to the merger effective date	20.31%	29.69%	50.00%

Table 4. Percentage of Systems Experiencing a Post-merger change in cost estimates

Table 5 categorizes the weapon systems by defense market sector to determine if cost estimate changes are positively or negatively statistically significant within each sector, following the methodology in Hensel (2007). The largest percentage of the defense market to experience a statistically significant difference in post-merger cost estimates is within Strategic Electronics with 72% of the sector showing a cost change, 44% of which is a cost increase. Roughly one-third of the Rotary Wing Aircraft sector demonstrated a statistically significant cost increase. Sixty percent of the Fixed Wing sector and 25% of the Strategic Missile sectors shows a statistically significant decrease in cost estimates. These percentages suggest that the Strategic Electronic sector had a propensity for cost increases and that the Rotary Wing sector had a propensity for cost decrease following defense industry consolidation. The Tactical Missile category, while

over half of the programs indicated a statistically significant cost change, had a slight propensity for cost increases. The programs analyzed in the Surface Ships category, however, saw neither a decrease nor increase in cost estimates. It is difficult to draw substantial conclusions from the categories of Munition, Expendable Launch Vehicle, Tracked Combat Vehicle, Submarine, Torpedo, since there is only one program within each of the categories.

Defense Market Sector	Weapon System	Percentage of a defense market sector experiencing statistically significant higher cost estimate post-merger	Percentage of a defense market sector experiencing statistically significant lower cost estimate post-merger	Percentage of defense market sector experiencing statistically significant different cost estimate post-merger
Rotary Aircraft	AH-64 (AAH)	33.33%	0.00%	33.33%
	Comanche (RAH-66)			
	Longbow Apache			
Tactical Missile	AIM-9X	33.33%	20.00%	53.33%
	AMRAAM			
	ATACMS			
	JSOW			
	MLRS			
	Patriot Pac-3			
	STD MSL 2 (BLKS I-IV)			
	Stinger RMP			
	THAAD			
	TOW2			
Strategic Electronics	ADDs	44.44%	27.78%	72.22%
	AFATDS			
	ASAS			
	B-1 CMUP-JDAM			
	CEC			
	CMU			
	FBCB2			
	JSIPS			
	MCS (ATCCS)			
	NAS			
	NAVSTAR User Eqmt			
	NESP			
	SMART-T			

Defense Market Sector	Weapon System	Percentage of a defense market sector experiencing statistically significant higher cost estimate post-merger	Percentage of a defense market sector experiencing statistically significant lower cost estimate post-merger	Percentage of defense market sector experiencing statistically significant different cost estimate post-merger
Fixed Wing Aircraft	AV-8B Remanufacture	0.00%	60.00%	60.00%
	C-130H			
	C-17A			
	F/A-18 E/F			
	F-22 (ATF)			
	Global Hawk			
	JPATS			
	JSTARS			
	T-45TS			
Surface Ships	DDG-51	16.67%	16.67%	33.33%
	LHD 1			
	LPD 17			
	Strategic Sealift			
Satellite	DMSP	0.00%	0.00%	0.00%
	SBIRS			
Munition	JDAM	0.00%	100.00%	100.00%
Strategic Missile	Minuteman III PRP	0.00%	25.00%	25.00%
	Tomahawk			
	Trident II MSL (D-5)			
Expendable Launch Vehicle	Titan IV	0.00%	100.00%	100.00%
Tracked Combat Vehicle	Bradley FVS	0.00%	100.00%	100.00%
Submarine	SSN-21/AN/BSY-2	0.00%	0.00%	0.00%
Torpedo	MK-48 ADCAP	0.00%	100.00%	100.00%

Table 5. Percentage of Weapons Systems Experiencing a Post-merger Change in Cost Estimates by Equipment Category

Table 6 categorizes the weapon system by the branch of service to which each program belongs. Half or more of the programs within each service experienced a statistically significant cost change; the Air Force with 62%, the Army with 52%, and the Navy with 50% cost estimate changes. The analysis results suggest that Navy and Air

Force programs were more likely to have cost estimate decreases post-merger (43% & 36%, respectively) while the Army programs were more likely to have a cost estimate increase (38%).

Branch of Service	Weapon System	Percentage of programs by service branch experiencing statistically significant higher cost estimate post-merger	Percentage of programs by service branch experiencing statistically significant lower cost estimate post-merger	Percentage of programs by service branch experiencing statistically significant different cost estimate post-merger
Air Force	AMRAAM	19.05%	42.86%	61.90%
	B-1 CMUP-JDAM			
	C-130H			
	C-17A			
	CMU			
	DMSP			
	F-22 (ATF)			
	Global Hawk			
	JDAM			
	JPATS			
	JSIPS			
	JSTARS			
	Minuteman III PRP			
	NAS			
	NAVSTAR User Eqmt			
	SBIRS			
	Titan IV			
Army	ADDs	38.10%	14.29%	52.38%
	AFATDS			
	AH-64 (AAH)			
	ASAS			
	ATACMS			
	ATACMS-BAT			
	Bradley FVS			
	Comanche (RAH-66)			
	FBCB2			
	Longbow Apache			
	MCS (ATCCS)			
	MLRS			
	Patriot Pac-3			
	SMART-T			
	Stinger RMP			
	THAAD			
	TOW2			

Branch of Service	Weapon System	Percentage of programs by service branch experiencing statistically significant higher cost estimate post-merger	Percentage of programs by service branch experiencing statistically significant lower cost estimate post-merger	Percentage of programs by service branch experiencing statistically significant different cost estimate post-merger
Navy	AIM-9X	13.64%	36.36%	50.00%
	AV-8B Remanufacture			
	CEC			
	DDG-51			
	F/A-18 E/F			
	JSOW			
	LHD 1			
	LPD 17			
	MK-48 ADCAP			
	NESP			
	SSN-21/AN/BSY-2			
	STD MSL 2 (BLKS I-IV)			
	Strategic Sealift			
	T-45TS			
	Tomahawk			
	Trident II MSL (D-5)			

Table 6. Percentage of Programs Experiencing a Post-merger Change in Cost Estimates by Branch of Service

Table 7 categorizes the weapon systems by the prime contractor responsible for program performance, following Hensel (2007). Boeing, Northrop Grumman, and General Dynamics' post-merger effects on cost changes show that costs were more likely to decrease than increase. Of particular note is that not only did 70% of Boeing's programs experience statistically significant cost changes, but also 60% of those programs had a propensity for cost decreases.

General Motors is not considered a top five defense contractor; however, five programs met all analysis criteria for inclusion in this study and are useful in examining the other categories. Regression results indicated that 60% of General Motors' programs experienced a statistically significant difference in cost estimates post-merger. During

their consolidation periods, 40% of those programs had a propensity for cost increases while only 20% were likely to decrease in costs post merger.

Once again, it becomes difficult to draw substantial conclusions from categories containing only one program, as is the case with McDonnell Douglas and ATK.

Prime Contractor	Weapon System	Percentage of programs by prime contractor experiencing statistically significant higher cost estimate post-merger	Percentage of programs by prime experiencing statistically significant lower cost estimate post-merger	Percentage of programs by prime experiencing statistically significant different cost estimate post-merger
Northrop Grumman	FBCB2	14.29%	28.57%	42.86%
	Global Hawk			
	JSTARS			
	LHD 1			
	LPD 17			
	MLRS			
Boeing	AV-8B Remanufacture	10.00%	60.00%	70.00%
	B-1 CMUP-JDAM			
	C-17A			
	Comanche (RAH-66)			
	F/A-18 E/F			
	JDAM			
	Longbow Apache			
	NAVSTAR User Eqmt			
Lockheed Martin	T-45TS	31.25%	25.00%	56.25%
	ASAS			
	ATACMS			
	ATACMS-BAT			
	C-130H			
	DMSP			
	F-22			
	MCS (ATCCS)			
	SBIRS			
	THAAD			
	Titan IV			
	Trident II MSL (D-5)			
General Dynamics	Bradley FVS	0.00%	33.33%	33.33%
	DDG-51			
	SSN-21/AN/BSY-2			
	Strategic Sealift			

Prime Contractor	Weapon System	Percentage of programs by prime contractor experiencing statistically significant higher cost estimate post-merger	Percentage of programs by prime experiencing statistically significant lower cost estimate post-merger	Percentage of programs by prime experiencing statistically significant different cost estimate post-merger
Raytheon	AFATDS	33.33%	27.78%	61.11%
	AIM-9X			
	AMRAAM			
	CEC			
	CMU			
	JPATS			
	JSIPS			
	JSOW			
	NAS			
	NESP			
	Patriot Pac-3			
	SMART-T			
	STD MSL 2 (BLKS I-IV)			
McDonnell Douglas	AH-64	0.00%	0.00%	0.00%
General Motors	ADDS	40.00%	20.00%	60.00%
	MK-48 ADCAP			
	Stinger RMP			
	Tomahawk			
	TOW2			
ATK	Minutemann III PRP	0.00%	0.00%	0.00%

Table 7. Percentage of Programs Experiencing a Post-merger Change in Cost Estimates by Prime Contractor

Table 8 summarizes the post-merger cost estimates in terms of the company's role as target or acquirer. The majority of programs (52%-58%), regardless of whether a company was a target or the acquirer, experienced a statistically significant difference in post-merger cost estimates. Approximately half of the programs a target company saw a cost estimate increase, the other half, of course, saw a cost decrease. More programs are needed in which to draw a more definitive conclusion.

The acquirer company, on the other hand, showed a greater likelihood of cost estimate decreases post merger. This suggests that larger companies, while working on a defense program, are acquiring companies that are able to provide added experience, specialization, technique, or other cost saving benefit and are more likely to experience a lower post-merger cost estimate.

	Percentage of programs by role in M&A experiencing statistically significant higher cost estimate post-merger	Percentage of programs by role in M&A experiencing statistically significant lower cost estimate post-merger	Percentage of programs by role in M&A experiencing statistically significant different cost estimate post-merger
Target	25.81%	25.81%	51.61%
Acquirer	21.21%	36.36%	57.58%

Table 8. Percentage of programs experiencing a post-merger change in cost estimates by the company's role during the consolidation experience.

C. CHAPTER SUMMARY

The analysis found that cost changes were statistically significant and of similar values regardless of whether the post-merger effects were assumed to occur at the SAR report date nearest the merger or at the next following SAR report date past the merger, which was consistent with Hensel (2007). The programs were then categorized by defense market sectors, branch of services, prime contractors, and, finally, by the role of a company during the merger or acquisition. From the categorization, trends emerged concerning the likelihood of cost changes depending on the category examined.

Viewing the tables independently, the categorical analysis depicts some trends. In the defense market sector, Rotary Aircraft, Tactical Missile, Strategic Electronics saw cost estimate increases post-mergers; Fixed Wing aircraft saw lower cost estimates post-mergers. By branch of service, the Air Force and the Navy's programs saw cost estimate decreases post merger; the Army saw higher cost estimates. By prime contractor,

Lockheed Martin, and Raytheon saw cost increases (General Motors saw cost increases as well, but is not a top five defense contractor); Northrop Grumman, Boeing, and General Dynamics experienced lower program cost estimates post-merger.

As viewed collectively, there also seem to be some identifiable trends. While Boeing displayed post-merger, cost estimate decreases, those decreases seemingly were not passed through to the Army for whom it was building Rotary Wing Aircraft, as evidenced by the sector's propensity for experiencing higher cost estimates post-merger. Likewise, the Army's propensity to experience higher cost estimates post-merger could also be affected through Raytheon's production of tactical missiles. Raytheon experienced higher cost estimates and is the predominant manufacturer of tactical missiles for which a large portion is for the Army.

Surface Ships and Fixed Wing Aircraft, for which the Air Force and the Navy are the prominent customers, are made, for the most part, by Northrop Grumman, Boeing, and General Dynamics. All these companies experienced lower cost estimates post merger and could be a contributing factor to both the Air Force and the Navy's lower cost estimates post merger.

The Strategic Electronics defense market sector covers such a broad arena that it becomes more difficult to infer cost change conclusions. The systems within Strategic Electronics are spread throughout all branches of service and contractors. Likewise, it becomes difficult to draw substantial conclusions from categories containing only one program data point. However, the single data point from one category adds to data points in other categories, thus making the empirical output more robust.

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V. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

Throughout the post Cold War 1990s, defense spending has decreased and consolidation among the defense industry has increased. A wide review of literature emphasized that many people within the public, political, and academic arenas have been concerned about competition, innovation, and, ultimately, cost growth. The literature also noted that there are some problems with the SAR database, to include inaccurate estimations, untimely submittals, and base year changes; however, the SAR, because it is used as a Congressional decision tool, is basically accepted as accurate for analysis purposes. From the SAR database, the raw data was organized and analyzed to identify cost trends of various programs (that met our analysis criteria) and to assist in gaining answers to the research questions posed at the beginning of this thesis. This analysis is by no means all inclusive and is intended to supplement past and future research in this area. This chapter, and thesis, closes with recommended areas for further study and analysis.

B. CONCLUSIONS

1. Primary Research Question

1. Has defense industry consolidation from 1993-2006 saved acquisition costs for various Major Defense Acquisition Programs (MDAP)?

While consolidation may yield savings as a result of synergy, this does not seem to be true for all mergers; they do not always save costs. Furthermore, not every merger experiences a statically significant cost estimate change. Comparison of regression results across all the examined programs suggests that when there is a statistically significant cost change following a merger, that change shows a greater likelihood a cost estimate decrease than an increase. A categorical comparison across defense market sectors, branch of services, prime contractors, and by the company's role during the consolidation experience (i.e., Target or Acquirer) suggest potential trends in cost estimate changes within each category.

2. Secondary Research Questions

1. Why did the Department of Defense (DoD) encourage defense industry consolidation and what policies were developed to support and encourage consolidation?

A review of literature suggests that DoD encouraged defense industry consolidation as a means to reduce excess, post-Cold War, industrial capacity. The literature further suggests that DoD aided in preparing the defense industry for the precipitous decrease in defense expenditures. Perhaps the most influential DoD policy to encourage consolidation was the payment of restructuring costs. DoD waived what was once an unallowable cost and began to pay restructuring costs associated with consolidation provided there was evidence of cost savings to the government.

2. What were the acquisition policy objectives regarding consolidation?

The acquisition policy objectives were to help the U.S. maintain a viable and healthy defense industry in light of reduced defense expenditures, without undermining competition or innovation. Paying consolidation restructuring costs, provided the appropriate ratio of savings to payouts (2 to 1) is achieved, were a means not only to encourage consolidation but also to strive for efficiencies so the government would pay the restructuring costs.

3. What were the acquisition policy outcomes regarding costs?

The literature review suggests that restructuring savings were less than expected, but did occur. Some people claim that companies used downsizing the workforce in order to gain enough savings to warrant the government's payment of restructuring costs. Others argue that market pressures would facilitate natural mergers without the need for monetary incentives. The literature also indicated that overall program costs have increased by an average of 30 percent. A few program savings were over 10 percent, but some incurred cost increases of over 500 percent. The regression analysis in this thesis suggests a decrease in cost estimates following a merger was more likely than an increase, which is consistent with Hensel (2007).

4. What effect did the defense industry consolidation have on competition?

Consolidation occurred rapidly between 1993 and 1997 to a point where further consolidation received added scrutiny from DoD and the antitrust agencies to prevent stifling competition or innovation. The DoD has not discouraged further consolidation or divestiture, but continues to monitor the health of the defense industry in order to preserve defense industrial capabilities.

5. How did program costs change immediately post-merger?

Not every merger experiences a statically significant cost estimate change during program performance. The regression analysis, when the merger effect is assumed to occur at the nearest SAR report date, suggests a greater tendency for statistically significant decreases in cost estimates than increases, which is consistent with the findings in Hensel (2007).

6. How did program costs change post-merger allowing time lag (i.e., for synergistic effects to be realized)?

The regression analysis, when allowing for a time lag post-merger, suggests that not all weapon system estimates were affected by mergers; however, when statistical significance exists, cost estimates were more likely to have a statistically significant reduction in cost estimates than an increase, which is consistent with Hensel (2007).

7. How did consolidation affect program costs within various defense sectors?

The percentage of defense markets to experience a statistically significant difference in post-merger cost estimates suggest that the Strategic Electronic sector had a propensity for cost increases and that the Rotary Wing sector had a propensity for cost decrease resulting from defense industry consolidation. The Tactical Missile category, while over half of the programs indicated a statistically significant cost change, had a slight propensity for cost increases. The programs analyzed in the Surface Ships sector, however, saw neither a decrease nor increase in cost estimates. Singular programs within the defense sectors of Munition, Expendable Launch Vehicle, Tracked Combat Vehicle, Submarine, and Torpedo, limited substantial conclusions for cost change experiences.

8. How did consolidation affect program costs within each branch of service?

The analysis results suggest that Navy and Air Force programs were more likely to have cost estimate decreases post-merger while the Army programs were more likely to have a cost estimate increase.

9. How did consolidation affect program costs with prime contractors within the defense industry?

Boeing, Northrop Grumman, and General Dynamics' post-merger effects on cost changes show that costs were more likely to decrease than increase. The analysis suggests that Boeing's programs had the greater propensity for cost estimate decreases post-merger. Once again, singular programs for particular prime contractors (McDonnell Douglas and ATK) limited substantial conclusions for cost change experiences.

It is difficult to pinpoint why certain contractors yielded savings while others showed cost increase. Possibilities of cost savings may be attributed to synergistic effects such as improved efficiency through organizational restructure, improvements in technology, or capitalization of particular expertise. Cost increases may result from merger-related synergies that were not realized or perhaps additional program requirements necessitated an increased expenditure. Unforeseen increases in overhead, labor rates, and material costs could also spur increases in program costs.

C. RECOMMENDATION

Accurate information is necessary for the government to set realistic project costs. Standardized cost reporting provides project cost estimators with actual historical data in which to monitor, forecast, and estimate future program and contract costs. With accurate program cost estimates, it may be possible to alter contract types that shift more cost risk to the contractor. For instance, a firm fixed price contract places all cost risk onto the contractor, whereas a cost reimbursement contract shifts more risk to the government. Contractual clauses may be a means to stabilize costs. A clause to reassess program costs after mergers and to alter contracts accordingly may help incentivize companies to keep costs lower.

While consolidation may be necessary to reduce excess capacity, to absorb specialty technology/techniques, or to garner market power, competition is in the best interest of the government to keep costs low and encourage innovation. Without competition, companies can charge whatever they consider appropriate, at the government's expense. Mergers during contract performance should show a cost savings, but it is not always the case; regardless, increased costs erode government agency's limited budget. Within the limited budget apportionment, there must be a zero sum gain – an increase in costs of one program must have a decrease in expenditure in another.

Since the literature suggests that there is room for improvement with SAR reporting, this is the first area that needs attention. DoD needs to provide more accurate program cost estimates. The review of literature has found various means and models in which to achieve more accurate estimates. Secondly, normalizing all programs reported in SAR by using a standard base year, a standard inflationary rate, and a per unit cost may simplify future analysis as well as provide an easier cross-program comparison of cost estimates. Lastly, it is important to monitor the payments of restructuring costs aggressively to see if the policy needs to be reconsidered.

D. FUTURE RESEARCH

Further research on individual unit costs may show a more detailed look at cost changes pre- and post-mergers. A similar, time trend analysis of cost per unit can show the differences in cost estimates with and without a merger. Delving into a contractor's financials can give a better estimate of the benefits of a merger from an accounting perspective as well as a return on investment comparison.

This analysis focused on the top five defense contractors and omitted the impacts of smaller acquisitions on program cost estimates. Further investigation on how these smaller companies affect particular programs could enrich this analysis. Capitalizing on a smaller company's niche in the market could be a cost savings driver.

This study does not look at services. The Government Accountability Office estimates that Department of Defense obligations for service contracts have more than doubled since fiscal year 1996, rising from \$66.4 billion to \$141.2 billion in fiscal year

2005. Since around 60 percent of defense budget expenditures are for services contracts, the study of DoD-wide cost impacts is abbreviated by only looking at major defense programs. Perhaps, if data is available, exploring the acquisition of services may yield insights to merger impacts on cost estimates.

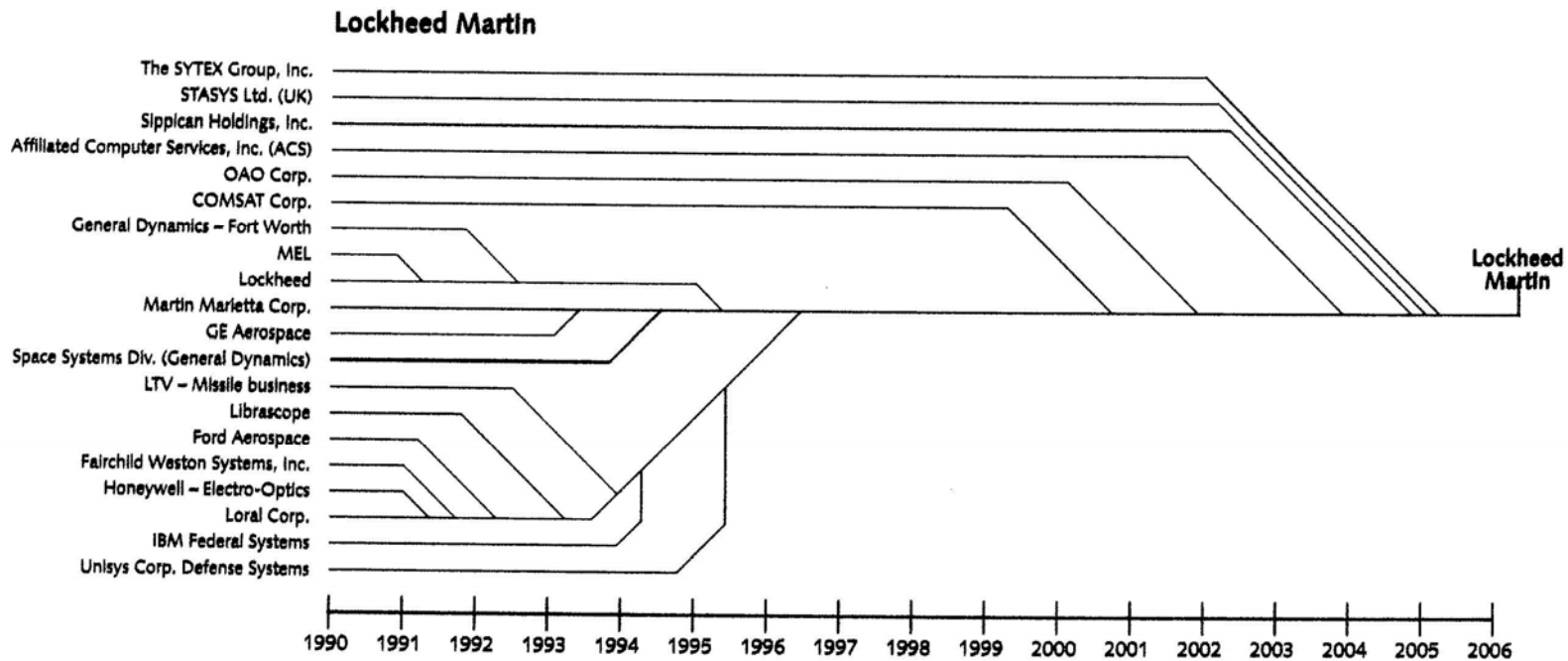
Program costs are reported in various ways, each with slightly different purposes or intended for different audiences. Some are used for internal management and while others are used to separate various colors of money. To create a more robust cost estimate picture, conducting and comparing regression analysis using other cost estimate reports such as Defense Acquisition Executive Summaries, Management Decision Package data, Acquisition Program Baselines, National Defense Budget Estimates, or Congressional Data Sheets could display noticeable cost change trends due to industry consolidation. Similarly, the same type of analysis can be done on branch of services using data contained within branch specific databases such as Standard Army Procurement Accounting System (SAPAS), Standard Operations and Maintenance, Army, and Research and Development System, or other derivatives. Reconciling the SAR cost data with the Presidential budget may indicate to what extent or impact poor cost estimates translate to budget requests.

The author understands that many of these programs have long since ceased either through termination or program completion; however, many programs are still ongoing. The trend analysis suggests that consolidation has resulted in decreased costs estimates on defense programs. Whether this translates to a decrease in actual costs is an entirely different subject needed for study. Conducting regression analysis using Program Objective Memorandum budget execution data or other comptroller actual cost data, may provide an effective cost change determination tool.

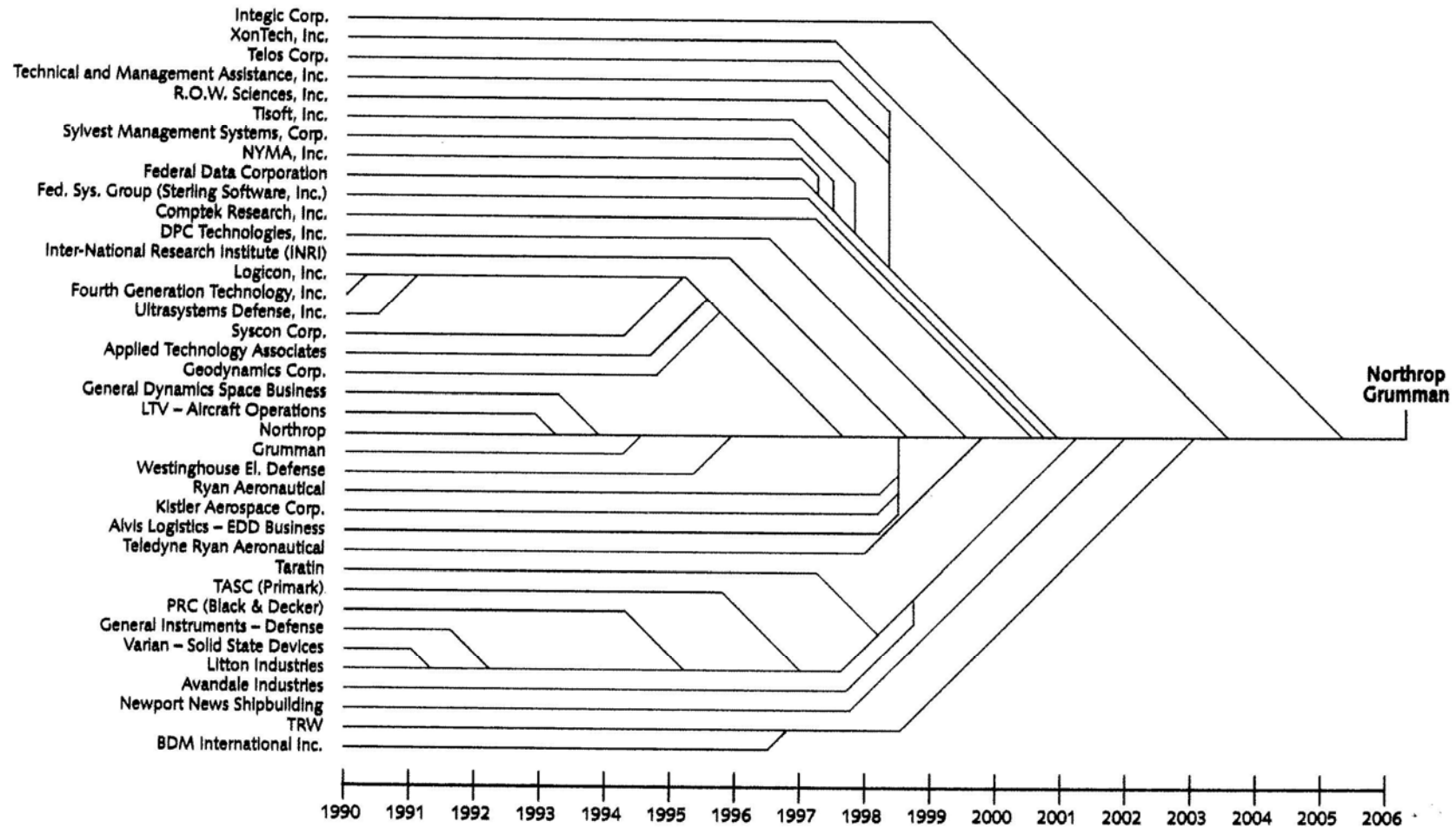
This study did not look at type of contract used for the various programs. An additional study may delve deeper to see what contract vehicles are used with the various projects to see if any correlation exists between contract type and overall program costs. For instance, do sole source contracts with a cost plus fixed fee arrangement have a proclivity for cost overruns?

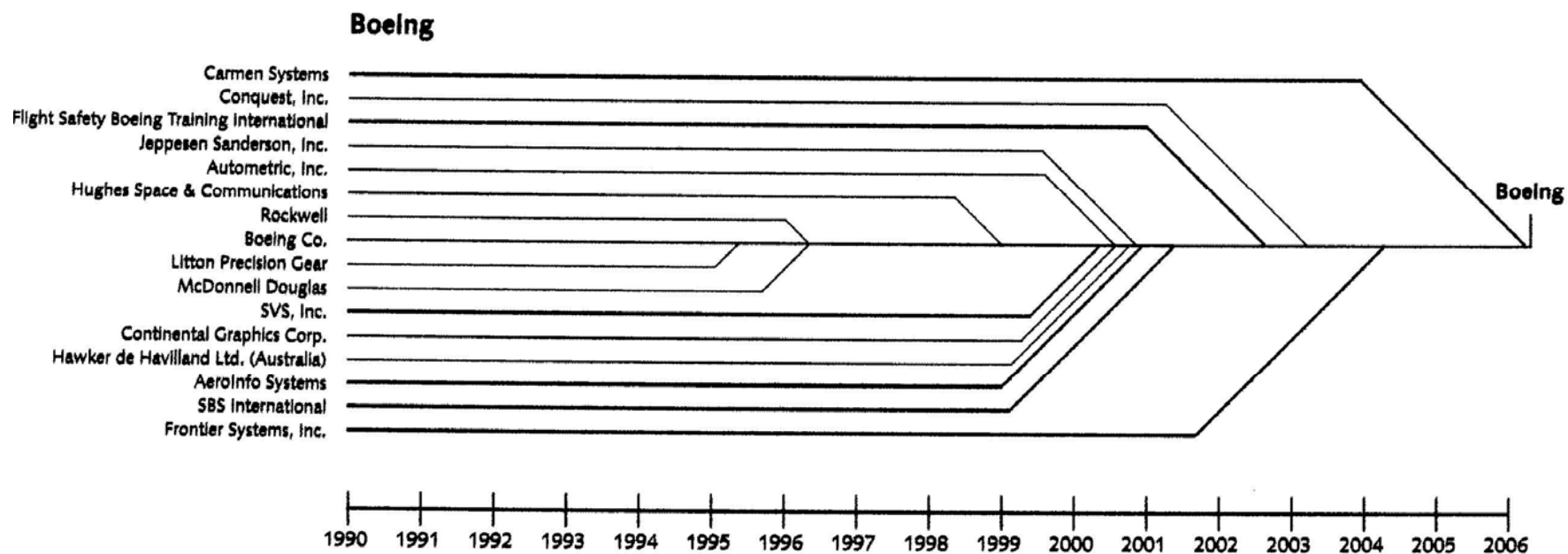
APPENDIX. TOP-5 DEFENSE INDUSTRY CONSOLIDATION DIAGRAMS

The following diagrams depict how consolidation has occurred chronologically from 1990 – 2006.

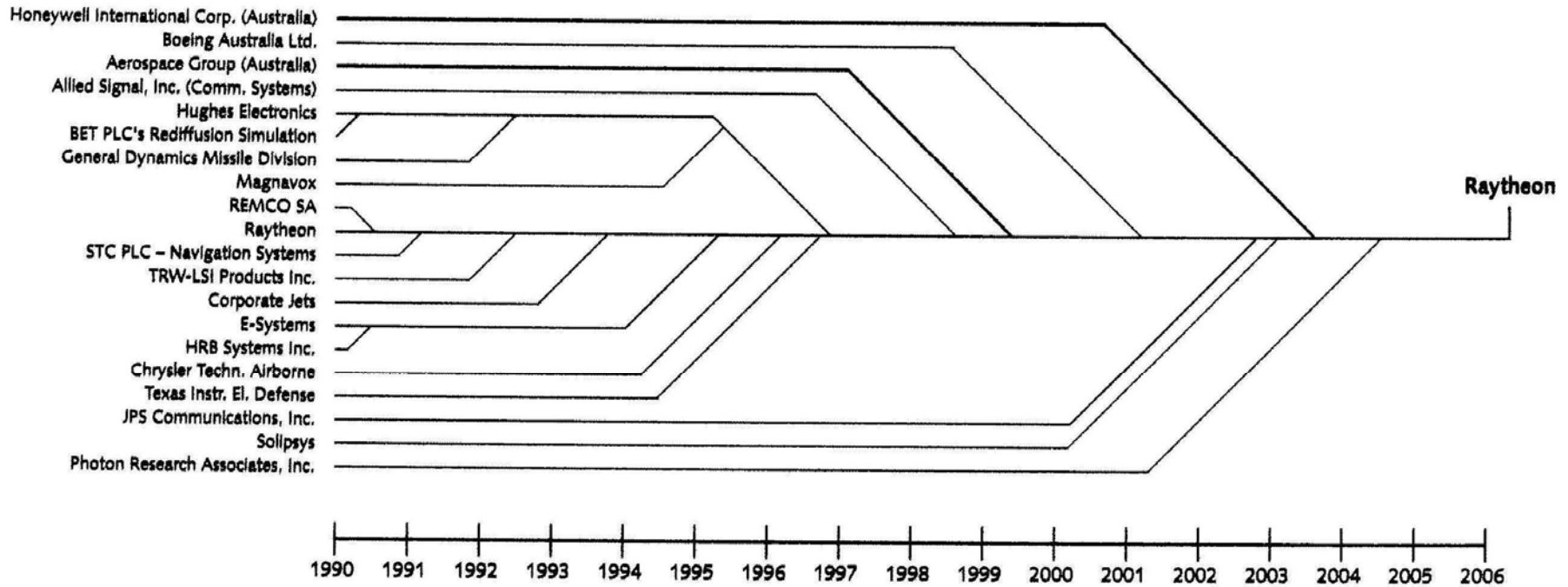


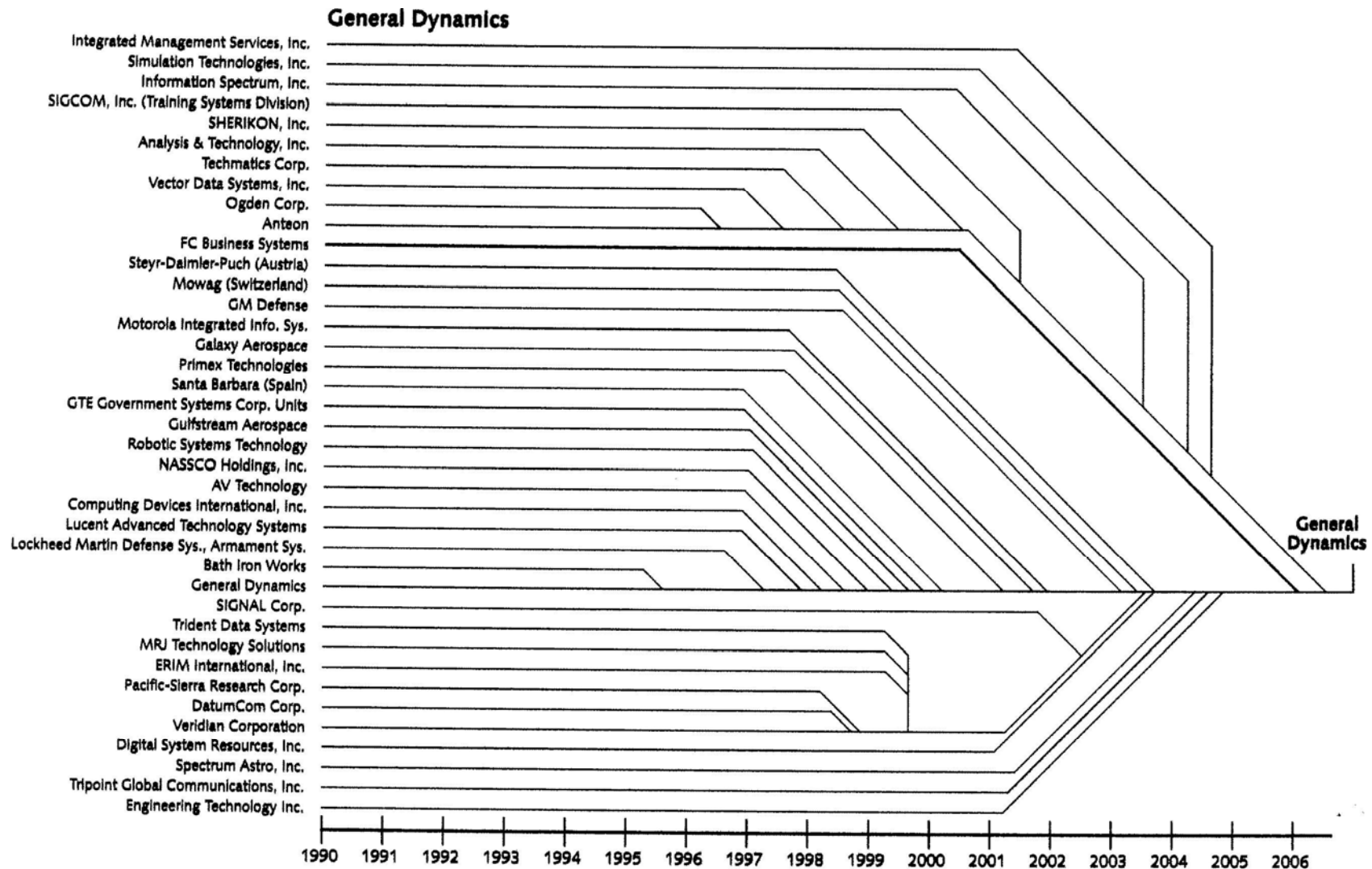
Northrop Grumman





Raytheon





Sources: DM&A, *Washington Technology*, various company reports, and analysis by CSIS Defense Industrial Initiatives Group.

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